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WAVE FINITE ELEMENT METHOD FOR VIBRATION OF PERIODIC STRUCTURES SUBJECTED TO EXTERNAL LOADS

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The wave finite element method (WFE) for the vibration of waveguides and periodic structures bases on the decomposition of vectors of degree of freedom (DOF) into left and right waves. This technique permits to reduce all DOF inside the periodic structure. However, this method cannot be applied easily if the periodic structure is subjected to complex or density loads.

This article presents an extended WFE for any type of loads. Firstly, the dynamic equation is rewritten to separate the vectors of loads and DOF. Then, by using the same wave base as for the free-loaded structure, we can obtain a decomposition of DOF in this base with a new component which corresponds to the loads. Finally, this decomposition is applied to the classical approaches of WFE.

For the dynamic stiffness matrix (DSM approach), it is shown that the external loads have no contribution to the global matrix but they lead to an equivalent load in the dynamic equation. Otherwise, the wave analysis (WA approach) is represented by a new component which is the wave amplitudes of the loads. Some computations on simple structures show the efficiency of the method.

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